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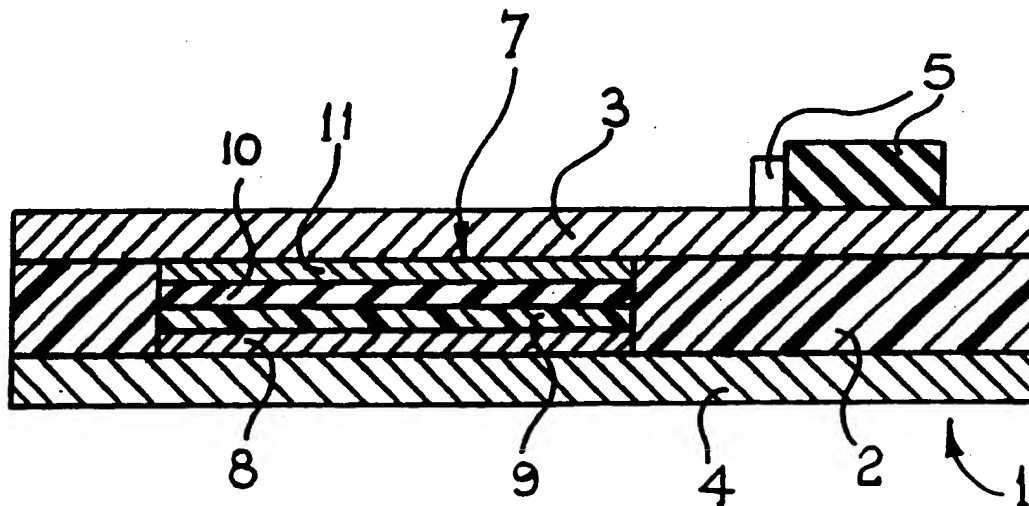
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(54) Title: ELECTRICAL POWER SUPPLY



(57) Abstract

The invention provides a circuit board (1) incorporating an integrally formed electrical power cell (7). By forming the cell within the board (1), the need for a case for the cell (7) and the requirement for connecting wires is eliminated reducing weight and component count over known arrangements.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 92/00688

| I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC Int.C1. 5 H05K1/16; H05K1/18; H01M2/10 | | | | | | | | | | | |
|--|--|-------------------------------------|---|--|-------------------------------------|----------------------------------|--|---------------------------------|------------------------|-------------|-----|
| II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; border-bottom: 1px solid black;">Classification System</td> <td style="border-bottom: 1px solid black;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">Int.C1. 5</td> <td style="padding: 5px;">H05K ; H01M</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched⁸</div> | | | Classification System | Classification Symbols | Int.C1. 5 | H05K ; H01M | | | | | |
| Classification System | Classification Symbols | | | | | | | | | | |
| Int.C1. 5 | H05K ; H01M | | | | | | | | | | |
| III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="width: 70%; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">PATENT ABSTRACTS OF JAPAN vol. 15, no. 200 22 May 1991 & JP,A,3 053 584 (NEC CORPORATION) 7 March 1991 see abstract</td> <td style="vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="text-align: center; padding: 5px;">---</td> <td style="vertical-align: top; padding: 5px;">2,8</td> </tr> </table> <div style="font-size: small; padding: 5px;"> <p>¹⁰ Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> | | | Category * | Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹² | Relevant to Claim No. ¹³ | X | PATENT ABSTRACTS OF JAPAN vol. 15, no. 200 22 May 1991 & JP,A,3 053 584 (NEC CORPORATION) 7 March 1991 see abstract | 1 | A | --- | 2,8 |
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| A | --- | 2,8 | | | | | | | | | |
| IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="text-align: center; padding: 5px;">20 JULY 1992</td> <td style="text-align: center; padding: 5px;">29. 07. 92</td> </tr> <tr> <td style="border-bottom: 1px solid black;">International Searching Authority</td> <td style="border-bottom: 1px solid black;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">EUROPEAN PATENT OFFICE</td> <td style="text-align: center; padding: 5px;">GOOSSENS A. </td> </tr> </table> | | | Date of the Actual Completion of the International Search | Date of Mailing of this International Search Report | 20 JULY 1992 | 29. 07. 92 | International Searching Authority | Signature of Authorized Officer | EUROPEAN PATENT OFFICE | GOOSSENS A. | |
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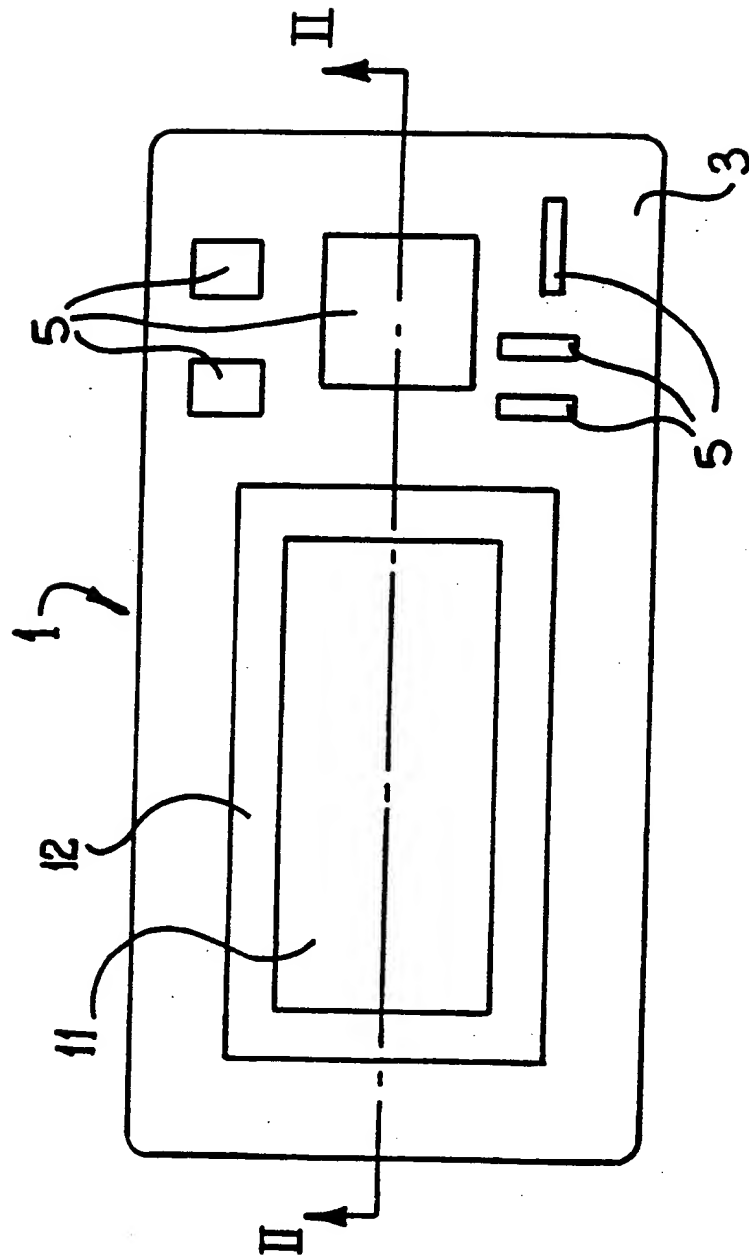


FIG. 1.

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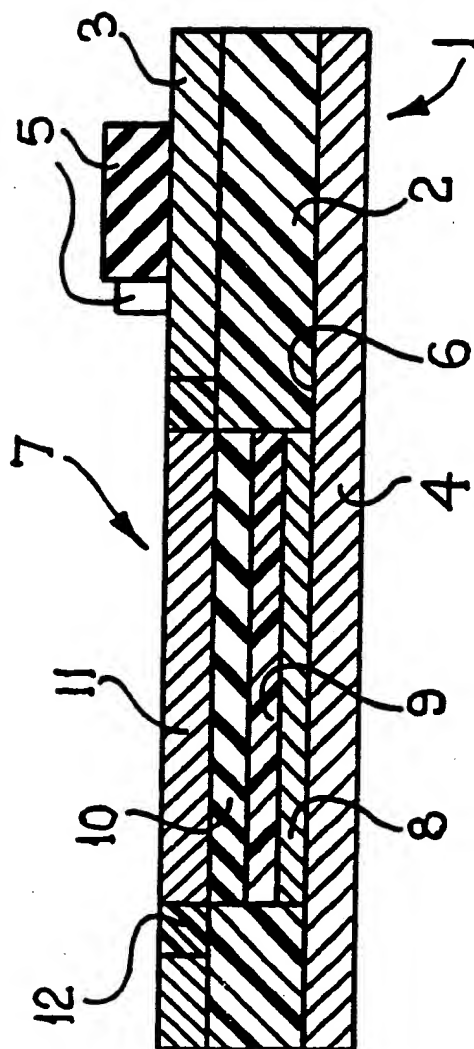


FIG. 2.

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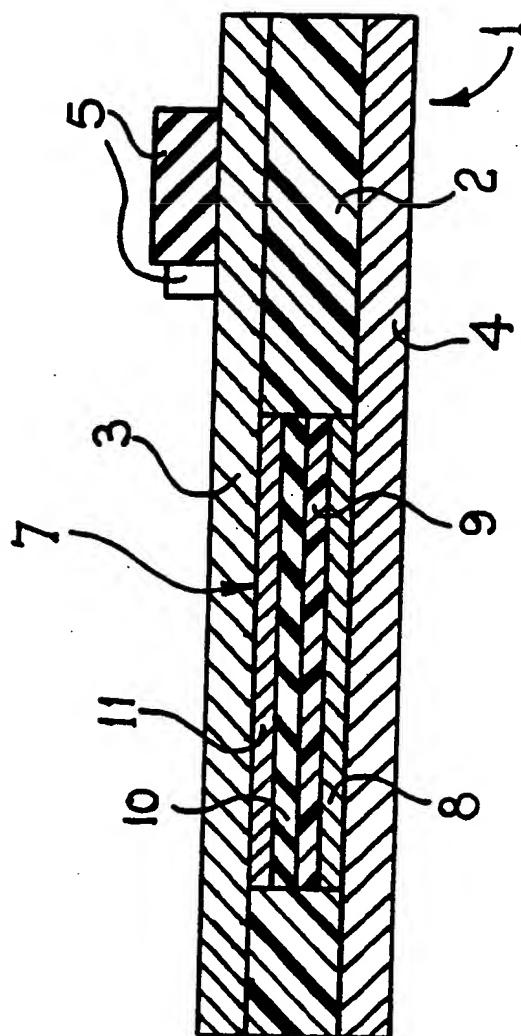


Fig. 3.

ELECTRICAL POWER SUPPLYField of the Invention

This invention relates to electrical power supplies for circuit boards.

Background of the Invention

It is generally desirable in electronic products to reduce the size and weight of circuits, and great advances have been made in this regard by the use of circuit boards such as printed circuit boards and integrated circuit components.

However, a limiting factor for battery powered electronic products has been the size and weight of the batteries currently available, which can now be the largest and heaviest components used in such products.

A further problem associated with batteries is the need to connect by clips or wires soldered to the battery the circuit it is to power. This adds undesirably to the component count and the number of operations to be performed to make the circuit.

Brief Summary of the Invention

In order to alleviate these problems, it is proposed according to the present invention to provide a circuit board with an electrical power supply comprising a cell formed integrally in the circuit board.

By forming the cell integrally in the circuit board, it is possible to eliminate the requirement for a separate casing, since in effect the circuit board performs that function. This allows a reduction in size and weight of the power supply, and allows it to be readily accommodated in the available space provided by the board. The cell may be rechargeable or nonrechargeable.

Electrical connections will be made to the cell by means of the electrically conductive surfaces of the circuit board. The electrically conductive surface will be that provided to be etched to a required circuit pattern and to which electronic components are soldered to form a circuit.

Commonly these surfaces are made of copper because of its good electrical conductivity. By making

the electrical connections to the battery by the conductive surface of the circuit board the requirement for separate clips or wires is eliminated.

The circuit board may be rigid or, where it is to conform to another shape, such as an inside surface of a case, it may be made flexible. Where it is flexible, the cell is also preferably flexible.

The cell may be formed in a cavity, depression, aperture or blind hole made in the surface of the circuit board by, for example, drilling or grinding. Where a hole is made through one of the surfaces, a vapour or gas proof layer may be provided to seal the hole against the ingress of contaminants and/or the leakage of vapour of gas as the cell operates.

Preferably, the vapour proof layer is electrically conductive to provide an electrical connection to the cell.

The vapour proof layer is preferably sealed at its junction with an adjacent electrically conductive layer of the circuit board by an electrically conductive sealant serving to provide a vapour proof seal and to electrically connect the layers.

Advantageously, the cell is formed within the board before addition of the electrically conductive surface or surfaces. The electrically conductive surfaces will then provide vapour proof layers eliminating the requirement for an additional layer and sealant.

Brief Description of the Drawings

Specific embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 shows a plan view of an electrical power cell and a circuit board in accordance with a first embodiment of the invention;

Figure 2 is a section along line II-II of Figure 1; and

Figure 3 is a section through an electrical power cell and circuit board in accordance with a second embodiment of the invention.

Detailed Description of the Preferred Embodiments

With reference to the Figures 1 and 2, a printed circuit board 1 has an electrically insulating resin core 2 clad by upper and lower electrically conductive copper layers 3 and 4 respectively.

The copper layers 3 and 4 are selectively etched, in a manner well known, to provide a network or circuit pattern of electrically conductive tracks (not shown). Circuit components 5 are soldered to these tracks to form a circuit. The components 5 may include microprocessors, resistors or other electronic/electrical components to suit the electrical application for which it is designed.

Within a blind square hole which extends through the upper copper layer 3 and the core 2 to an inner surface 6 of the lower copper layer 4 is located an electrical power cell 7.

The electrical power cell 7 is a lithium solid state battery and comprises an anode of lithium metal foil 8 placed in the hole in good electrical face-to-face contact with the lower copper layer 4. A layer of polymer electrolyte 9 is provided over the upper surface of the lithium foil 8.

A composite cathode 10, comprising a polymer and an active cathode material and an aluminium foil backing 11, is provided over the electrolyte layer 9.

The aluminium foil backing 11 provides a vapour proof covering as well as an electrical pick up from the cell 7. A fillet 12 of conductive epoxy sealant completes the vapour proofing of the cell 7 and additionally electrically connects the cell 7 to the upper copper layer 3.

Connection between the cell 7 and the circuit components 5 is completed by through hole plating (not shown) to the lower copper layer 4.

A second embodiment of the invention is shown in

Figure 3 in which like parts are given the same reference numbers as for the first embodiment. A cell 7 is in this case formed in an aperture in a core 2 of a circuit board 1 prior to a cladding process in which copper layers 3 and 4 are glued to the core 2. The layers 3 and 4 encapsulate the cell 7 preventing ingress of contaminants.

The copper layers 3 and 4 are then etched in a manner well known to provide a network of conductive tracks to which electronic components 5 are soldered to complete the board 1.

In alternative embodiments of the invention, a number of cells may be provided at different locations in the circuit board and electrically linked in series or parallel to give the required voltage and capacity.

Where the cell is located prior to cladding of the board with the conductive layers the vapour proof layer and sealant may be dispensed with, their function being performed by the conductive layers alone.

WE CLAIM:

1. A circuit board with an electrical power supply comprising at least one cell formed integrally in the circuit board.
2. A circuit board as claimed in claim 1 wherein electrical connections to the power supply are formed by at least one electrically conductive surface of the circuit board.
3. A circuit board as claimed in claim 1 or 2 wherein the or each cell is located in a cavity in the circuit board and sealed by a vapour and or gas proof layer.
4. A circuit board as claimed in claim 3 wherein the vapour and or gas proof layer is electrically conductive to provide an electrical connection to the cell.
5. A circuit board as claimed in claim 4 wherein the vapour and or gas proof layer is sealed at its junction with an adjacent

electrically conductive layer of the circuit board by an electrically conductive sealant to provide a vapour and/or gas proof seal and to electrically connect the layers.

6. A circuit board as claimed in claim 2 wherein at least one electrically conductive surface of the board provides a vapour and or gas proof layer.

7. A circuit board as claimed in any preceding claim wherein the board and cell are flexible.

8. A method of forming a circuit board comprising providing a core clad with first and second electrically conductive layers, forming a hole through the first layer, forming a cell within the hole in good electrical contact with the second layer, forming a vapour and or gas proof electrically connecting the vapour and or gas proof layer electrically conductive layer and the first layer.